



Section 6: Technology Education 2006-2007

Need course information?

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Section 6: Technology Education Course Descriptions, Sequences, Certifications, Career Clusters

Section Overview

This section presents course information applicable to the Technology Education program area: course descriptions, course concentration and specialization sequences, certifications available to course completers, and career clusters. Following the course description, the remainder of the information for each course or course sequence is presented in a chart. The following definitions and criteria are summarized to clarify and enhance the chart components.

Sequences

- A *concentration* is a coherent sequence of courses completed by a student in a specific career area as identified in this planning guide.
- A *specialization* is a choice by a student to specialize in an occupational field by taking additional courses in a specific career area as identified in this planning guide.
- A career and technical education *completer* is a student who has met the requirements for a career and technical concentration or specialization and all requirements for high school graduation or an approved alternative education program.

Certifications/Licenses/Assessments Available

Certain courses enable student completers to earn industry certification, a state license, and/or a national certification. These credentials are beneficial (and sometimes essential) to students seeking employment in a career field or occupational specialty. In addition, students who obtain these credentials earn verified credits toward graduation.

- A *standard credit* is based on a minimum of 140 clock hours of instruction and successful completion of the requirements of the course.
- A *verified credit* is based on a standard credit plus a passing score on the end-of-course SOL test (or other test as described in the Standards of Accreditation 8 VAC 20-131-110). A standard credit may not be verified more than once.
- A *student-selected verified credit* is a credit for a course that includes a test (other than SOL) approved by the Virginia Board of Education.

For students to be eligible to receive student-selected verified credits, their teacher must be certified by the issuing organization relative to the industry certification or licensure. In the case of a CTE program area where there are potential multiple certifications, the teacher must be certified in at least one industry certification that is related to the course and/or course sequence. ***Exception:*** There is no teacher certification requirement for students to receive verified credits upon passing a selected NOCTI assessment related to their CTE program.

Verified credits (other than those earned through NOCTI) entitle students to the Career and Technical Education diploma seal. Some verified credits earn students the Advanced Mathematics and Technology seal. Each year, the Virginia Board of Education approves the industry certifications that enable students to earn these seals.

Additional information and the relationships among Board-approved examinations, verified credits, and diploma seals are explained in the Introduction and in Section 9. Additional information, including the description of each credential, how to earn it, and courses that may prepare students for examination, is contained in Section 10: Descriptions of Certifications, Licenses, and Assessments.

Career Clusters

To help students investigate careers and design their courses of study to advance their career goals, the Office of Career and Technical Education Services in Virginia has adopted the nationally accepted structure of career clusters, career pathways, and sample career specialties or occupations.

To simplify federal reporting, *The Career and Technical Education Reporting System (CTERS) User's Manual* assigns a career family to each course. The family is also listed here.

Additional information and samples of CTE course selection using career clusters are included in Section 11: Instructional Planning with Career Clusters, Career Pathways, and Occupations.

Middle School Courses

Note: Careers and You is reported in the Education and Training career cluster; Introduction to Technology, Inventions and Innovations, and Technological Systems are reported in the Science, Technology, Engineering, and Mathematics career cluster. Completer sequences and certifications do not apply.

Course Title and Code	Section 12 Page
• Careers and You 8475	12-5
• Introduction to Technology 8483, 8482, 8484, 8481	12-5
• Inventions and Innovations 8464, 8461, 8485	12-5
• Technological Systems 8462, 8463, 8486	12-6

High School Course Credit in Middle School

Local school divisions may offer certain high school courses to students in middle school and award secondary credit to those students who master the secondary state-approved course competencies. The Technology Education secondary courses that may be offered in middle school for high school credit are **Geospatial Technology 8423**, **Materials and Processes Technology 8433**, and **Technology Foundations 8403**.

Design and Technology

Technology Foundations 8403

Grade Level: 9, 10, 11, or 12 (36 weeks)

Technology Foundations 8402

Grade Level: 9, 10, 11, or 12 (18 weeks)

In the beginning high school course in the Design and Technology program, students acquire a foundation in technological material, energy, and information and apply processes associated with the technological thinker. Challenged by laboratory activities, students create new ideas and innovations, build systems, and analyze technological products to learn further how and why technology works. They work in groups to build and control systems with engineering in the development of a technology.

Technology Transfer 8405

Grade Level: 10, 11, or 12 (36 weeks)

Technology Transfer 8404

Grade Level: 10, 11, or 12 (18 weeks)

Prerequisite: Technology Foundations

Students work with a variety of computers, materials, and systems to improve their skills and knowledge. Groups work together, applying math, science, and communication concepts, on a project that combines systems such as production, energy, communication, transportation, biotechnology, and other technologies. Thematic activities engage students in community problems where they transfer the technological method to address recycling, space exploration, and housing.

Technology Assessment 8407

Grade Level: 11 or 12 (36 weeks)

Technology Assessment 8406

Grade Level: 11 or 12 (18 weeks)

Prerequisite: Technology Transfer

Technology Assessment is offered as a capstone course for students in high school. Students use their knowledge and abilities in math, science, and technology to analyze the contributions of technical devices to their homes and the world. Students use information they acquire through library research or computer databases to predict the future. They design futuristic products and use assessment to determine possible results. They also use computer graphics, videotapes, and design portfolios to present their newly created products and systems.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Technology Foundations 8403 and one of the following: <ul style="list-style-type: none"> • Technology Transfer 8405 • Technology Assessment 8407 	<ul style="list-style-type: none"> • Technology Foundations 8403 • Technology Transfer 8405 • Technology Assessment 8407 	N/A	Science, Technology, Engineering, and Mathematics
	Technology Foundations 8403 and two courses from following programs: <ul style="list-style-type: none"> • Pre-Engineering Program • Communication and Information Technology Program • Control Technology Program • Production Technology Program • Technical Design and Illustration Program • Biotechnology Program 		

Engineering, Option 1

Introduction to Engineering 8490

Grade Level: 10, 11, or 12 (36 weeks)

While undergoing an orientation to the careers and challenges of engineering, students are actively involved with high-tech devices, engineering graphics, and mathematical concepts and scientific principles through problem-solving experiences. Activities in descriptive geometry, materials science, and technical systems challenge students as they communicate information through seminars, technical reports, and idea sharing.

Advanced Engineering 8491

Grade Level: 11 or 12 (36 weeks)

Prerequisite: Introduction to Engineering

To learn the applications and design process of engineering, students form engineering teams and select a group design problem. Each team uses communications, graphics, mathematics, and community resources to solve problems. Each team learns appropriate information in order to complete a project. Projects may be models, systems, or products that creatively solve an engineering problem.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> • Introduction to Engineering 8490 • Advanced Engineering 8491 	Introduction to Engineering 8490 and Advanced Engineering 8491 and one course from the following programs: <ul style="list-style-type: none"> • Design and Technology Program • Communication and Information Technology Program • Control Technology Program • Production Technology Program • Technical Design and Illustration Program • Biotechnology Program 	Available upon completion of Introduction to Engineering 8490 or Advanced Engineering 8491: <ul style="list-style-type: none"> • Pre-Engineering/Engineering Technology Assessment (NOCTI) 	Science, Technology, Engineering, and Mathematics

Engineering, Option 2

Principles of Engineering 8441

Grade Level: 9 (36 weeks)

Students in Principles of Engineering develop an understanding of the engineering profession and the fundamental aspects of engineering problem solving. Students study the historical and current impacts of engineering on society as well as ethical implications. Mathematical and scientific concepts will be applied to fundamental engineering topics, including mechanics and electrical circuit theory.

Introduction to Engineering Design 8439

Grade Level: 9-10 (36 weeks)

Using computer-modeling software, students learn the design process. They solve design problems as they develop, create, and analyze product models.

Digital Electronics 8440

Grade Level: 10-11 (36 weeks)

Students use computer simulations to learn about the logic of electronics as they design, test, and actually construct circuits and devices. They apply control system programming and explore sequential logic and digital circuitry fundamentals. Topics in computer circuitry are also presented, including circuitry analysis and an exploration into diodes, transistors, and operational amplifiers.

Computer Integrated Manufacturing 8442

Grade Level: 11-12 (36 weeks)

Students learn concepts of robotics and automated manufacturing by creating three-dimensional designs with modeling software and producing models of their designs. Students use CNC equipment to produce actual models of their three-dimensional designs. Fundamental concepts of robotics used in automated manufacturing and design analysis are included.

Engineering Design and Development 8443

Grade Level: 12 (36 weeks)

Students enrolled in the Engineering Design and Development course synthesize knowledge, skills, and abilities through an authentic engineering experience. Students are expected to develop and formally present an independent study project and a team-oriented project, with are critiqued by an evaluation committee. Students interact and work with community mentors to research, design, and construct solutions to engineering problems.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none">Principles of Engineering 8441Introduction to Engineering Design 8439Digital Electronics 8440	<ul style="list-style-type: none">Principles of Engineering 8441Introduction to Engineering Design 8439Digital Electronics 8440 and one of the following courses: <ul style="list-style-type: none">Computer Integrated Manufacturing 8442Engineering Design and Development 8443	Available upon completion of Principles of Engineering 8441, Introduction to Engineering Design 8439, or Digital Electronics 8440: <ul style="list-style-type: none">Pre-Engineering/Engineering Technology Assessment (NOCTI)	Science, Technology, Engineering, and Mathematics

Communication and Information Technology

Computer Control and Automation 8421 (formerly Computing Systems)

Grade Level: 9, 10, or 11 (36 weeks)

Computer Control and Automation 8420 (formerly Computing Systems)

Grade Level: 9, 10, or 11 (18 weeks)

Students engage in a broad study of the technical aspects of computers and their applications to production, transportation, and communication systems. Topics include computer equipment and operating systems, programming, control processing information, and social/cultural impact of computers. Problem-solving activities challenge students to plan, program, and interface devices with computer systems. Learning activities include experiences with robotics and control systems, computer-aided design, and computer-aided manufacturing.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Computer Control and Automation 8421 and one of the following: <ul style="list-style-type: none"> • Communication Systems 8415 • Graphic Communications Systems 8458 	Computer Control and Automation 8421 and two of the following: <ul style="list-style-type: none"> • Communication Systems 8415 • Electronics Systems 8416 • Graphic Communication Systems 8458 • Production Systems 8447 • Manufacturing Systems 8425 	Available upon completion of Computer Control and Automation 8421: <ul style="list-style-type: none"> • IT Essentials Certificate Level 1 (Cisco Systems) 	Information Technology

Communication Systems 8415

Grade Level: 9, 10, 11, or 12 (36 weeks)

Communication Systems 8418

Grade Level: 9, 10, 11, or 12 (18 weeks)

This course provides experiences related to various modes of communicating information, using data, technical design, optics, graphic production, audio and video, and integrated systems. Students solve problems involving input, process, output, and feedback processes. Also, students learn about potential career choices related to communication and impact of communication on society.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Communication Systems 8415 and one of the following: <ul style="list-style-type: none"> • Graphic Communications Systems 8458 • Computer Control and Automation 8421 • Geospatial Technology 8423 • Imaging Technology 8455 	Communication Systems 8415 and two of the following: <ul style="list-style-type: none"> • Computer Control and Automation 8421 • Electronics Systems 8416 • Geospatial Technology 8423 • Graphic Communications Systems 8458 • Imaging Technology 8455 	Brainbench Desktop Publishing Software Certifications	Information Technology

Graphic Communications Systems 8458**Grade Level:** 10, 11, or 12 (36 weeks)**Graphic Communications Systems 8494****Grade Level:** 10, 11, or 12 (18 weeks)

This course provides experiences related to a wide range of tools and materials used to reproduce information and images. Several mediums are used, including paper, metal, plastic, and fabric. Students develop competencies in message design, composition and assembly, film conversion and assembly, and message transfer and product conversion.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Graphic Communication Systems 8458 and one of the following: <ul style="list-style-type: none"> • Communication Systems 8415 • Graphic Communications Systems 8458 • Imaging Technology 8455 	Graphic Communications Systems 8458 and two of the following: <ul style="list-style-type: none"> • Technology Foundations 8403 • Communication Systems 8415 • Computer Control and Automation 8421 • Technology Foundations 8403 • Imaging Technology 8455 • Geospatial Technology 8423 	Brainbench Desktop Publishing Software Certifications	Arts, Audio-Video Technology and Communications

Geospatial Technology 8423**Grade Level:** 9, 10, 11, 12 (36 weeks)

The Geospatial Technology program provides experiences pertaining to the study of geographic information systems (GIS), global positioning systems (GPS), remote sensing (RS), digital image processing simulator (DIPS), Geodesy, Automated Cartography (Auto-Carto), Land Surveying (LS), and navigation. Fundamentally, these technologies allow students to explore and analyze the natural and human-made world, from local to global and beyond. Students will use various tools, processes, and techniques to create, store, access, manipulate, and revise data to solve human challenges. These experiences will employ real-world spatial analysis models and guidelines for integrating, interpreting, analyzing, and synthesizing data, with a focus on both the implications and the limitations of such technologies. These experiences also include the interfacing to telecommunications and automated data base management systems.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Geospatial technology 8423 and one of the following courses <ul style="list-style-type: none"> • Communication Systems 8415 • Imaging Technology 8455 	Geospatial Technology 8423 and two of the following courses: <ul style="list-style-type: none"> • Communication Systems 8415 • Imaging Technology 8455 • Technology Foundations 8403 	N/A	Information Technology

Imaging Technology 8455**Grade Level:** 9, 10, 11, 12 (36 weeks)

Imaging Technology introduces students to the basic principles of photography while providing a strong emphasis on digital imaging. Students study the development of photography as a communication medium and its evolution into the digital realm. Students learn to use image-editing software to manipulate digital images.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Imaging Technology 8455 and one of the following courses: <ul style="list-style-type: none"> • Communication Systems 8415 • Geospatial Technology 8423 • Video and Media Technology 8497 	Imaging Technology 8455 and two of the following courses: <ul style="list-style-type: none"> • Communication Systems 8415 • Geospatial Technology 8423 • Graphic Communication Systems 8458 • Video and Media Technology 8497 	N/A	Arts, Audio-Video Technology and Communications

Video and Media Technology 8497

Grade Level: 10, 11, 12 (36 weeks)

This course offers students an opportunity to study all aspects of video and media production, from planning and writing for production to operating studio and editing equipment. Students practice various methods of gathering news and information from individuals, research, and online resources. In addition, students are introduced to analog and digital principles of film production.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> • Video and Media Technology 8497 • Communication Systems 8415 	<ul style="list-style-type: none"> • Video and Media Technology 8497 • Communication Systems 8415 • Graphic Communications Systems 8458 	N/A	Arts, Audio-Video Technology and Communications

Control Technology

Electronics Systems I 8416 (36 weeks)

Electronics Systems I 8417 (18 weeks)

Grade Level: 9, 10, 11, or 12

This course engages students in electricity and electronic experiments that focus on the application of scientific theories and mathematics principles. Students solve problems using simple electrical devices and circuits and build electronic projects using dc and ac devices and circuits.

Electronics Systems II 8412

Grade Level: 10, 11, or 12 (36 weeks)

Prerequisite: Electronics Systems I

Students work with electronics devices, instruments, and circuits, building projects to apply theories and laws with electronic components such as resistors, capacitors, and transistors. They also study integrated circuits used in computers, amplifiers, television, and other equipment.

Electronics Systems III 8413

Grade Level: 11 or 12 (36 weeks)

Prerequisite: Electronics Systems II

Electronics III teaches advanced electronic concepts, focusing on cutting-edge digital electronics, microprocessors, and automation. Students analyze emerging technologies related to the electronics industry while studying theory, using electronic test equipment, and investigating careers related to electrical engineering.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> Electronics Systems I 8416 Electronics Systems II 8412 	<ul style="list-style-type: none"> Electronics Systems I 8416 Electronics Systems II 8412 Electronics Systems III 8423 	Available upon completion of Electronics Systems II or III: <ul style="list-style-type: none"> A+ (CompTIA) A+ Operating Systems Technologies Examination (CompTIA) A+ Core Hardware Examination (CompTIA) Certified Electronics Technician Associate (ETA) Electronic Technology Assessment (NOCTI) Student Electronics Technician Certification (SET) (ETA) 	Science, Technology, Engineering, and Mathematics

Power and Transportation 8445

Grade Level: 9, 10, or 11 (36 weeks)

Power and Transportation 8444

Grade Level: 9, 10, or 11 (18 weeks)

Students survey the many broad sources of energy and power used in power and transportation systems. Instruction in this single-period course includes ways that (1) energy is converted to power; (2) power is transmitted and controlled; and (3) power is used through mechanical, fluid, and electrical devices. Students explore career opportunities in power and transportation fields and build projects, conduct experiments, and repair mechanical devices such as small engines, electrical motors, and outboard motors.

Energy and Power 8448

Grade Level: 10, 11, or 12 ((36 weeks)

Energy and Power 8495

Grade Level: 10, 11, or 12 (18 weeks)

In this single-period laboratory course, students learn about the application of power and energy systems to common power devices and transportation vehicles and apply theory to the practical servicing of common machines such as small gasoline engines, outboard motors, motorcycles, and lawn mowers.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> Power and Transportation 8445 Energy and Power 8448 	<ul style="list-style-type: none"> Power and Transportation 8445 Energy and Power 8448 Electronics Systems I 8416 	N/A	Transportation, Distribution, and Logistics

Production Technology

Construction Technology 8431

Grade Level: 10, 11, or 12 (36 weeks)

Construction Technology 8432

Grade Level: 10, 11, or 12 (18 weeks)

In this single-period laboratory course, students design, build, and test scale-model structures and work with projects that help them to understand the jobs of architects, carpenters, electricians, plumbers, surveyors, contractors, masons, design engineers, and a variety of other construction careers. (This course is a companion to Manufacturing Systems.)

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Construction Technology 8431 and one of the following: <ul style="list-style-type: none"> • Production Systems 8447 • Materials and Processes Technology 8433 • Manufacturing Systems 8425 	Construction Technology 8431 and two of the following: <ul style="list-style-type: none"> • Production Systems 8447 • Manufacturing Systems 8425 • Materials and Processes Technology 8433 	N/A	Architecture and Construction

Materials and Processes Technology 8433

Grade Level: 9, 10, or 11 (36 weeks)

Materials and Processes Technology 8478

Grade Level: 9, 10, or 11 (18 weeks)

Students focus on industrial/technical materials and processes as they fabricate usable products and conduct experiments. Learning experiences include career analysis as well as the use of tools and equipment related to analysis, testing, and processing of metals, plastics, woods, ceramics, and composite materials. This course is recommended for students interested in technical careers and others wishing to improve their consumer knowledge and technological literacy.

Production Systems 8447

Grade Level: 9, 10, or 11 (36 weeks)

Production Systems 8446

Grade Level: 9, 10, or 11 (18 weeks)

Students assess the relationship between production and society as they compose design portfolios, construct production prototypes, and apply automation to evaluate their solutions to technological problems.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Materials and Processes Technology 8433 and one of the following courses: <ul style="list-style-type: none"> • Production Systems 8447 • Construction Technology 8431 • Manufacturing Systems 8425 	Materials and Processes Technology 8433 and two of the following courses: <ul style="list-style-type: none"> • Production Systems 8447 • Construction Technology 8431 • Manufacturing Systems 8425 • Advanced Manufacturing Systems 8427 	N/A	Manufacturing

Manufacturing Systems 8425**Grade Level:** 10, 11, or 12 (36 weeks)**Manufacturing Systems 8426****Grade Level:** 10, 11, or 12 (18 weeks)

This course provides an orientation to careers in various fields of manufacturing. Emphasis will be placed on the major systems in automated manufacturing, including design, electrical, mechanical, manufacturing processes, material handling, and quality control. Students participate in teams produce manufacturing projects that demonstrate critical elements of manufacturing.

Advanced Manufacturing Systems 8427**Grade Level:** 11 or 12 (36 weeks)**Prerequisite:** Manufacturing Systems 8425 (36 weeks)

Students develop an in-depth understanding of automation and its applications in manufacturing. Activities center on flexible manufacturing processes and computer integrated manufacturing (CIM). Students work in teams to solve complex interdisciplinary problems that stem from the major systems in automated manufacturing.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> Manufacturing Systems 8425 Advanced Manufacturing Systems 8427 	Manufacturing Systems 8425 and Advanced Manufacturing Systems 8427 and one course from any of the following programs: <ul style="list-style-type: none"> Design and Technology Program Pre-Engineering Program Communication and Information Technology Program Control Technology program Production Technology Program Technical Design and Illustration Program Biotechnology Program 	Available upon completion of Manufacturing Systems or Advanced Manufacturing Systems: <ul style="list-style-type: none"> Manufacturing Technology (NOCTI) 	Manufacturing

Information Technology in Production Systems 8496**Grade Level:** 9, 10, 11, 12 (36 weeks)

Information Technology in Production Systems provides experiences pertaining to the core elements of information technology (information services and support, network systems, programming and software development, and interactive media) with an emphasis on the following technical systems: communication, construction, manufacturing, transportation, and biotechnology. Students also work in teams to gain an understanding of the ways information-based project are managed and implemented in various career fields.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Information Technology in Production Systems 8496 and one of the following courses: <ul style="list-style-type: none"> • Production Systems 8447 • Construction Technology 8431 • Manufacturing Systems 8425 • Advanced Manufacturing Systems 8427 	Information Technology in Production Systems 8496 and two of the following courses: <ul style="list-style-type: none"> • Production Systems 8447 • Construction Technology 8431 • Manufacturing Systems 8425 • Advanced Manufacturing Systems 8427 • Electronics Systems I 8416 • Power and Transportation 8445 	Available upon completion of Information Technology in Production Systems sequence: <ul style="list-style-type: none"> • A+ Certification (CompTIA) • A+ Operating Systems Technologies Examination (CompTIA) • A+ Core Hardware Examination (CompTIA) • IT Essentials Certificate Level 1 (Cisco Systems) 	Manufacturing

Technical Design and Illustration

Technical Drawing/Design 8435

Grade Level: 9, 10, or 11 (36 weeks)

Technical Drawing/Design 8434

Grade Level: 9, 10, or 11 (18 weeks)

In this foundation course, students learn the basic language of technical design, and they design, sketch, and make technical drawings, models, or prototypes of real design problems. The course is especially recommended for future engineering and architecture students.

Engineering Drawing/Design 8436

Grade Level: 10, 11, or 12 (36 weeks)

Engineering Drawing/Design 8493

Grade Level: 10, 11, or 12 (18 weeks)

Prerequisite: Technical Drawing/Design

Students use a graphic language for product design, technical illustration, assembly, patent, and aeronautical drawings. They increase their understanding of drawing techniques learned in the prerequisite course. Students use computers, calculators, and descriptive geometry and adhere to established standards to solve design problems. Throughout the course, they hold seminars, meet engineers, and tour technical design firms in order to learn about the benefits of the course on their future study and career. Completion of this course may contribute to a student's preparation for the AutoCAD 2000 certification examination.

Architectural Drawing/Design 8437

Grade Level: 10, 11, or 12 (36 weeks)

Architectural Drawing/Design 8492

Grade Level: 10, 11, or 12 (18 weeks)

Prerequisite: Technical Drawing/Design

Students learn the principles of architecture and increase understanding of working drawings and construction techniques learned in the prerequisite course. Experiences include residential and commercial building designs, rendering, model making, structural details, and community planning. Students use computer-aided drawing and design (CAD) equipment and established standards or codes to prepare models for presentation. The course provides information helpful for the homeowner and is especially beneficial to the future architect, interior designer, or homebuilder.

Digital Visualization 8459

Grade Level: 10, 11, 12 (36 weeks)

Prerequisite: Technical Drawing/Design 8435

Students will gain experiences related to computer animation by solving problems involving 3D object manipulation, storyboarding, texture mapping, lighting concepts, and environmental geometry. They will produce animations that include interdisciplinary projects related to science, engineering, and the entertainment industry. A major emphasis will be the production of a portfolio that showcases examples of original student work.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
Technical Drawing/Design 8435 and one of the following courses: <ul style="list-style-type: none">• Architectural Drawing/Design 8437• Engineering Drawing/Design 8436• Digital Visualization 8459	Technical Drawing/Design 8435 and two of the following courses: <ul style="list-style-type: none">• Engineering Drawing/Design 8436• Architectural Drawing/Design 8437• Digital Visualization 8459	Available upon completion of any Technical Drawing and Illustration course: <ul style="list-style-type: none">• AutoCAD Certifications (includes 2000, 2002, and 2004) (Brainbench)	<ul style="list-style-type: none">• Science, Technology, Engineering, and Mathematics• Architecture and Construction (Architectural Drawing/Design only)

Principles of Technology

Principles of Technology I 9811

Grade Level: 10, 11, or 12 (36 weeks)

Students in this single-period laboratory science course apply physics and mathematics concepts through a unified systems approach to develop a broad knowledge base of the principles underlying modern technical systems. Students study seven technical principles: force, work, rate, resistance, energy, power, and force transformers, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This "principles and systems" approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

Principles of Technology II 9812

Grade Level: 11 or 12 (36 weeks)

Prerequisite: Principles of Technology I (36 weeks)

Students continue to apply physics and mathematics concepts through a unified systems approach to expand their knowledge base of the principles underlying modern technical systems. This course focuses on seven technical principles: momentum, waves, energy converters, transducers, radiation, optical systems, and time constants, emphasizing how each principle plays a unifying role in the operation of mechanical, fluid, electrical, and thermal systems in high-technology equipment. This "principles and systems" approach to studying these technical principles provides a foundation for further education and career flexibility as technology and technical systems advance.

Note: Students who complete Principles of Technology I (9811) and Principles of Technology II (9812) may use these courses to satisfy one (1) physics credit in laboratory science. A student must complete both courses in the sequence in order to receive laboratory science credit. The sequence of Principles of Technology I (9811) and Principles of Technology II (9812) will satisfy one (1) unit of credit in laboratory science for physics and one (1) elective credit. Students who enroll in Principles of Technology courses for a physics credit must have completed Algebra I and two (2) other laboratory science courses as specified by the accrediting standards prior to enrolling in Principles of Technology.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> Principles of Technology I 9811 Principles of Technology II 9812 	N/A	N/A	Science, Technology, Engineering, and Mathematics

Biotechnology Program

Biotechnology Foundations 8468

Grade Level: 10, 11, or 12

This course focuses on various techniques that are used to modify living organisms, or parts of organisms, to improve plants and animals, and the development of microorganisms for specific purposes. Student activities range from bioprocessing and genetic engineering to medicine, biomechanical systems, and the environment. Students gain insight and understanding about biotechnology career fields.

Bioengineering 8467

Grade Level: 11 or 12

Prerequisite: Biotechnology Foundations

The study of bioengineering combines engineering, medicine and other biological sciences. Students explore the process of designing and producing a variety of bio-based products. Student research and problem-based activities include a) designing artificial limbs and other organ substitutes, and b) producing and testing electronic instruments and advanced equipment used in biotechnology.

Concentration Sequences	Specialization Sequences	Certification/License/Assessment Available	Career Cluster
<ul style="list-style-type: none"> Biotechnology Foundations 8468 Bioengineering 8467 	<ul style="list-style-type: none"> Biotechnology Foundations 8468 Bioengineering Electronics Systems 8416 	N/A	Science, Technology, Engineering, and Mathematics

Other Courses

For information on the following courses, please contact the Technology Education Service, Virginia Department of Education:

- Technology Awareness (Grades K-5) 8410 (36 weeks)
- Dual Enrollment with Postsecondary 8498 (36 weeks)
- Technology Studies 8465 (36 weeks)
- Advanced Technology Studies 8466 (36 weeks)
- Career and Technical Education Occupational Exploration—Disadvantaged 8469 (36 weeks)
- Career and Technical Education Occupational Exploration—Disabled 8471 (36 weeks)
- Industrial Occupational Exploration 8472 (36 weeks); 8473 (18 weeks)